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Quantum oscillations in a bilayer with broken mirror symmetry: a minimal model for $\mathbf{YBa_2Cu_3O_{6+\delta}}$[1] AKASH MAHARAJ, YI ZHANG, Stanford University, BRAD RAMSHAW, National High Magnetic Field Laboratory, Los Alamos National Laboratory,, STEVEN KIVELSON, Stanford University — Using an exact numerical solution and semiclassical analysis, we investigate quantum oscillations (QOs) in a model of a bilayer system with an anisotropic (elliptical) electron pocket in each plane. Key features of QO experiments in the high temperature superconducting cuprate YBCO can be reproduced by such a model, in particular the pattern of oscillation frequencies (which reflect "magnetic breakdown" between the two pockets) and the polar and azimuthal angular dependence of the oscillation amplitudes. However, the requisite magnetic breakdown is possible only under the assumption that the horizontal mirror plane symmetry is spontaneously broken and that the bilayer tunneling, $t_\perp$, is substantially renormalized from its 'bare' value. Under the assumption that $t_\perp = \tilde{Z} t_\perp^{(0)}$, where $\tilde{Z}$ is a measure of the quasiparticle weight, this suggests that $\tilde{Z} 1/20$. Detailed comparisons with new $YBa_2Cu_3O_{6.58}$ QO data, taken over a very broad range of magnetic field, confirm specific predictions made by the breakdown scenario.

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